

EXECUTIVE SUMMARY

The purpose of this study was to prepare a water use inventory and an inflow / outflow analysis for the Jones River watershed and its subbasins (i.e., study area). This analysis considered the potential human and natural influences which affect the overall water budget of the study area. This study was designed as a first step in assisting watershed planners, local governments, state regulators, private industry, and local stakeholders in identifying key water resources management issues in the Jones River watershed. GZA GeoEnvironmental, Inc. conducted this study under contract with the Massachusetts Department of Environmental Management, Office of Water Resources, in conjunction with the Massachusetts Executive Office of Environmental Affairs (EOEA) Watershed Initiative, which gathers essential data and information needed for planning future watershed management. This report is subject to the Limitations in **Appendix A**.

The Jones River watershed drains approximately 29.8 square-miles (mi^2) from Tubbs Meadow Brook to Kingston Bay. The freshwater portion of the basin is about 26.9 mi^2 to the Elm Street Dam (including Halls Brook and Smelt Brook subbasins). There is a USGS stream gage on the Jones River, downstream of the Elm Street Dam, which has been in-service since 1967 and encompasses approximately 15.7 mi^2 (excluding 4.1 mi^2 above Silver Lake). About 84 percent of the watershed is underlain by stratified drift. Land in the watershed is approximately 52 percent forested, with residential land use accounting for 22 percent.

Legislation passed in 1899 has granted the City of Brockton the right to withdraw water from Silver Lake, the largest body of fresh water in the study area and the headwaters for the Jones River. The interbasin transfer of water from Silver Lake amounted to an average of 10.25 MGD according to the 1996 through 2000 Public Water Supply Statistical Reports, which is by far the largest water supply withdrawal in the watershed. Other water supplies are obtained from the basin, amounting to approximately 1.3 MGD from the 7 wells owned and operated by the Town of Kingston, 0.13 MGD from the Lake Shore well operated by the Town of Duxbury, and 1.24 MGD from the well within the watershed operated by the Town of Pembroke, as of 2000. Additionally, the approximately 740 acres of cranberry bogs within the watershed are estimated to need, but not necessarily consume, up to 15.8 MGD of water per year. Irrigation usage or flooding of bogs which occurs during the non-winter season does subject the withdrawn water to the effects of evapotranspiration.

Historic fisheries sampling results indicated populations typical for low-gradient, warm-water coastal Southeastern Massachusetts streams. Brook trout are stocked in the spring, although in the past the river reportedly supported a native trout population (Jones River Watershed Association, 2001). Anadromous species such as alewives were historically present in the watershed, but do not currently occupy the main stem of the Jones River upstream of the Wapping Road dam.

The August median flow as measured at the USGS stream gage on the Jones River at Elm Street is about 0.7 cubic feet per second per square mile of drainage area (cfs/m). The

water budget model developed by GZA for this study predicts an average of approximately 0.8 cfs of baseflow¹, assuming average precipitation and temperatures, during the critical late summer/early fall months and up to 2.5 cfs during spring for current (i.e., developed) conditions. Total streamflows² under developed conditions are estimated to range from 1.0 cfs in late summer/early fall to 3.8 cfs in spring. Dry-year precipitation (i.e., 1-in-20 year drought) conditions reduce the level of expected baseflows to about 0.4 cfs in late summer/early fall months and 1.0 cfs in spring under average precipitation, current withdrawal scenarios. Conditions in the future are expected to approximate current conditions as a result of water demand projections which are not anticipated to significantly increase by the year 2020.

Silver Lake is predicted to contribute to the Jones River during portions of the spring under current, developed conditions (and normal precipitation). For the remainder of the year, the elevation of the Lake is predicted to be below the level of the spillway at Forge Pond Dam, and thus not contribute significantly to the Jones River. When modeling the lake without Forge Pond Dam and without diversions to and from the Lake (i.e., natural conditions), an estimated 2.5 cfs in September to 40 cfs in spring is predicted to flow to the Upper Jones River. During periods where flow to the Upper Jones River is negligible, the river may not experience significant flow until the contributing drainage area allows for measurable groundwater outflows (baseflow).

The majority of the Jones River watershed currently contains flow rates to support aquatic habitat under the current level of permitted and registered water withdrawals. This conclusion is based on comparisons of our water budget-estimated existing subbasin flows to recommended US Fish and Wildlife Service (USFWS) in-stream flow targets for New England. The USFWS in-stream aquatic base flow (ABF) policy recommends instantaneous flows for New England streams of 0.5 cfs year-round; 1.0 cfs in the fall/winter; and 4.0 cfs for the spring for applicable spawning and incubation periods. In GZA's opinion, these flow recommendations are applicable to the Jones River Watershed in general and its subbasins, in particular. This assumes the use of a 3.2 cfs target in the Spring, instead of the USFWS value of 4.0 cfs, based on the long-term data provided by the USGS stream gage on the Jones River at Elm Street.

Although the watershed as a whole experiences streamflows which meet flow targets, there are nevertheless specific reaches of the Jones River and its tributaries that are flow-impaired. Flow-impaired portions of the watershed include the "Upper" Jones River (i.e., freshwater portion of the river above the Elm Street Dam) downstream of Forge Pond Dam and Pine Brook. Pine Brook is anticipated to be the least water-rich subbasin in the watershed, partly as a result of its natural geology: While most of the other subbasins are underlain by large coarse sand and gravel deposits, Pine Brook reportedly is not³. As a result, natural flows are expected to range from 0.3 cfs to 1.0 cfs, which is, at its lowest, below the USFWS target in-stream flow rates.

¹ Baseflow is the groundwater outflow component of streamflow (i.e., a constant discharge of water to the river; typically flow in a river several days after rainfall or during dry conditions is baseflow).

² Total Streamflow refers to a monthly average streamflow consisting of both baseflows and runoff flows.

³ USGS, 1991.

The water supply operations at Silver Lake were instituted in 1899 and result in seasonal water surface elevation fluctuations that, in turn, limit the amount of outflow to the Upper Jones River, particularly in the summer months. Natural flows from the Lake are estimated by GZA's water budget model to be 1.7 cfsm (about 7 cfs) during August, as compared to field-estimated flows of near zero during current August conditions. This is an indication that the Lake once typically provided a constant discharge of water to the Upper Jones River. Brockton continues to investigate alternate water supply sources in addition to controlling water demand, as Silver Lake cannot provide a stable drinking water supply to the City (the reported drinking water safe yield estimates for the Silver Lake system range from 8 to 10 MGD⁴, while historic average water demands have often exceeded 10 MGD).

The flow-impaired portions of the watershed should be subject to further, reach-specific investigation, including stream flow and precipitation monitoring, to assess the impacts of development and low flows. A strategic watershed plan should be developed to maximize the potential of the watershed to provide baseflows for aquatic habitat while allowing for the continued use of the water resources of the Jones River for the sustenance of human activity.

⁴ CDM, Draft Report to City of Brockton, Commissioner of Public Works, September 2, 1987.